

AP Multiple-Choice Review Questions

1. A 0.010-mole sample of K_2SO_4 is added to 1.0 L of each of two different solutions. One solution contains $2.0 \times 10^{-3} M$ $Ba(NO_3)_2$, and the other contains $2.0 \times 10^{-3} M$ $AgNO_3$. Which statement best describes what is observed? K_{sp} for $BaSO_4 = 1.5 \times 10^{-9}$; K_{sp} for $Ag_2SO_4 = 1.2 \times 10^{-5}$.
- (A) $BaSO_4$ would precipitate, but Ag_2SO_4 would not.
 (B) Ag_2SO_4 would precipitate, but $BaSO_4$ would not.
 (C) Both would precipitate.
 (D) Neither would precipitate.
2. For which of the following can we directly compare their K_{sp} values to determine their relative solubilities?
- (A) Ag_2CrO_4 and $AgBr$
 (B) Ag_2SO_4 and $CaSO_4$
 (C) $PbCl_2$ and $PbSO_4$
 (D) ZnS and AgI
3. The salt MX_2 has a solubility of $1.0 \times 10^{-4} M$. Determine the K_{sp} for MX_2 .
- (A) 1.0×10^{-4}
 (B) 1.0×10^{-8}
 (C) 1.0×10^{-12}
 (D) 4.0×10^{-12}
4. Three ionic salts, AX , BX_2 , and CX_3 , each have a solubility of $2 \times 10^{-5} M$. Which of the following correctly ranks the K_{sp} of the three salts from least to greatest?
- (A) $CX_3 < BX_2 < AX$
 (B) $AX < BX_2 < CX_3$
 (C) $BX_2 < CX_3 < AX$
 (D) $AX < CX_3 < BX_2$
5. Aqueous solutions of $NaCl$ and Na_2CrO_4 are mixed and they do not react. To this mixture an aqueous solution of $AgNO_3$ is added (dropwise). At first, a white solid forms. As the $AgNO_3$ solution continues to be added, a yellow solid begins to form. $AgCl(s)$ is white in color and $Ag_2CrO_4(s)$ is yellow. Which of the following is the most accurate conclusion based on these results?
- (A) The molar solubility of the $NaCl$ is greater than the molar solubility of Na_2CrO_4 because the white solid formed first.
 (B) The molar solubility of the $NaCl$ is less than the molar solubility of Na_2CrO_4 because the white solid formed first.
 (C) The molar solubility of $AgCl$ is greater than the molar solubility of Ag_2CrO_4 because the white solid formed first.
 (D) The molar solubility of $AgCl$ is less than the molar solubility of Ag_2CrO_4 because the white solid formed first.
6. Barium iodate has a K_{sp} of 4.0×10^{-9} . What is the iodate ion concentration in a saturated solution of barium iodate?
- (A) $1.0 \times 10^{-3} M$
 (B) $2.0 \times 10^{-3} M$
 (C) $6.3 \times 10^{-5} M$
 (D) $2.0 \times 10^{-9} M$
7. Which of these salts would have increased solubility in a $0.10 M$ solution of HNO_3 , compared with their solubilities in pure water at the same temperature?
- (A) $AgBr$
 (B) Hg_2Cl_2
 (C) $Mg(OH)_2$
 (D) PbI_2
8. When 0.10 mole of solid $Ag_2C_2O_4$ is added to 1 L of pure water at $25^\circ C$, a saturated solution results. The solubility of $Ag_2C_2O_4$ is $2.1 \times 10^{-4} M$. Which would be the correct setup to calculate the K_{sp} of $Ag_2C_2O_4$?
- (A) $K_{sp} = (2.1 \times 10^{-4})(2.1 \times 10^{-4})$
 (B) $K_{sp} = (2.1 \times 10^{-4})^2(2.1 \times 10^{-4})$
 (C) $K_{sp} = \frac{(2.1 \times 10^{-4})(2.1 \times 10^{-4})}{0.10}$
 (D) $K_{sp} = \frac{(2.1 \times 10^{-4})^2(2.1 \times 10^{-4})}{0.10}$
9. Ten grams of $Ca(OH)_2(s)$ is added, with stirring, to 100 mL of water, producing a saturated solution with solid $Ca(OH)_2$ on the bottom of the beaker. Which is true?
- (A) The addition of 30 drops of $3 M$ HCl will cause the K_{sp} of the reaction to decrease.
 (B) The addition of 0.1 mole of solid $Ca(NO_3)_2$ will cause some additional $Ca(OH)_2$ to form.
 (C) The addition of 0.1 mole of solid $NaOH$ will cause some additional $Ca(OH)_2$ to dissolve.
 (D) The addition of 0.1 mole of solid $Ca(OH)_2$ will cause the K_{sp} of the reaction to increase.
10. Solid sodium chloride was added to pure water slowly, with stirring, at $25^\circ C$ until no more sodium chloride would dissolve. Solid remained on the bottom of the container, even after the solution was stirred repeatedly over 8 hours. After the solid was allowed to settle, some of the clear, colorless solution was carefully poured off into a flask. This flask was placed in a refrigerator at a temperature of $4^\circ C$ for 2 hours. When the flask was removed from the refrigerator, a small amount of white solid was found to have appeared in the flask. What is the best explanation for this?
- (A) Solids settle out of solutions over time.
 (B) $NaCl$ has an exothermic heat of solution.
 (C) The K_{sp} of $NaCl$ decreases with decreasing temperature.
 (D) The K_{sp} of $NaCl$ increases with decreasing temperature.
11. Which of the following statements is true concerning the relative solubility of silver chloride? All samples are at the same temperature.
- (A) $AgCl$ is less soluble in $1.0 M$ $AgNO_3$ than it is in pure water.
 (B) $AgCl$ is less soluble in $1.0 M$ HNO_3 than it is in pure water.
 (C) $AgCl$ is more soluble in $1.0 M$ $AgNO_3$ than it is in pure water.
 (D) $AgCl$ is more soluble in $1.0 M$ HNO_3 than it is in pure water.

12. The K_{sp} of a hypothetical metallic hydroxide, MOH, is 1.0×10^{-4} . What is the pH of a saturated solution of MOH?

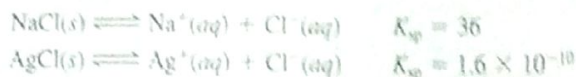
(A) 4.00
(B) 8.00
(C) 10.00
(D) 12.00

$$1.0 \times 10^{-4} = [M^+][OH^-]$$

$$[OH^-] = 1.0 \times 10^{-2}$$

$$pOH = 2.00, pH = 12.00$$

13. The solubility equations and K_{sp} values for two different chloride salts are shown below.



What can be interpreted from this information?

- (A) The K_{sp} of AgCl is so small that AgCl is completely insoluble.
(B) The K_{sp} of NaCl is so large that the reaction is not reversible.
(C) With NaCl, the forward reaction is favored. The relatively large equilibrium constant tells us that the products are favored.
(D) With AgCl, the forward reaction is favored. The relatively small equilibrium constant tells us that the products are favored.
14. The mineral fluorite is the main source of calcium fluoride. CaF_2 has a solubility of $2.2 \times 10^{-4} M$ in pure water. Which is a correct explanation for what occurs when solid CaF_2 is dissolved in an acidic solution, rather than in pure water?
- (A) The solubility increases because HF is a weak acid.
(B) The solubility increases because HF is a strong acid.
(C) The solubility decreases because HF is a weak acid.
(D) The solubility decreases because HF is a strong acid.

15. Aqueous solutions of Na_2CO_3 and $Ca(NO_3)_2$, 0.10 M each, are combined. A white precipitate is observed in the container after mixing. The precipitate is filtered and carefully rinsed with distilled water to remove other ions. A sample of the precipitate is added to 100 mL of 0.1 M NaCl. A second sample of the precipitate is then added to 100 mL of 0.1 M HCl. What would be observed in each case?

	Observation upon Addition of Precipitate to NaCl(aq)	Observation upon Addition of Precipitate to HCl(aq)
(A)	Additional precipitate forms.	No visible reaction occurs.
(B)	No visible reaction occurs.	Gas is produced, and some precipitate dissolves.
(C)	No visible reaction occurs.	No visible reaction occurs.
(D)	Additional precipitate forms.	Gas is produced, and some precipitate dissolves.

